Tensification Revisited

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1. Introduction

It seems that the *toyn soli*[1] phenomenon or tensification in Korean phonology has been satisfactorily dealt with neither in the generative, nor even in the descriptive terms. Relating to the problem of tensification, two crucial questions seem to be raised, which are actually not separate, but interrelated. The one is how to formalize the phenomenon, and the other is to explicate the unpredictable alternation of voicing and tensing of the five voiceless obstruents /p, t, c, k, s/[2] in the same environment.

Both questions will not be positively solved in the present study. Nor an ordered set of rules will be proposed that can generate either voiced or tensified obstruents in the same immediate phonetic environment in a regular and predictable way, since the task is intractable at the present stage of research.

My concern in this study will be by and large restricted to showing what rules are involved in tensification which occurs in various environments, and how the underlying representations are converted into the surface phonetic representations. However, an adequate explanation of the first question, I believe and hope, may shed light on the solution to the persistent problem of the unpredictable alternation between voicing and tensing.

2. Environments of Tensification and Kim's Treatment

In his insightful analysis of *sai sios* or epenthetic *s* in Korean with the purpose of incorporating it with boundary phenomena,[3] Kim (1970a) has formulated the following *t* epenthesis rule:

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[1] This paper follows the Yale Romanization system (Martin et al. 1967), and the language data is also from that dictionary.

[2] Of course, *s* does not undergo voicing.

[3] It should be evident that Kim's major concerns are the role of boundary element, not merely the description of epenthetic sounds. The area of interest is different between Kim's article and this paper. What I intend to point out is that *t* epenthesis and boundary phenomena seem insufficient for the explanation of tensification.

(1). *T* Epenthesis Rule

$$\phi \rightarrow t \;/\; \begin{Bmatrix} V \\ C \end{Bmatrix} + \;-\; + \; C$$

T is inserted in what Kim calls 'compound boundary' if the initial segment of the second element of the compound is a consonant. The phonetic forms in the following examples can be generated by this rule and other rules, as the sample derivations illustrate.

		Orthography	Pronunciation	
I.	1.	ip+pelus	ipp'ərit[4]	manner of speech
	2.	nac+cam	natc'am	nap
	3.	ttek+kwuk	t'ək'uk	rice-cake soup
	4.	os+som	ots'om	cotton for clothes
	5.	aph+kil	apk'il	future
	6.	path+kolang	patk'oraŋ	furrow
	7.	swuch+pwul	sutp'ul	charcoal fire
	8.	mith+cwul	mitc'ul	underline
	9.	nat+kali	natk'ari	stack
	10.	cip+cwuin	cipc'uin	the owner of a house
	11.	mok+toli	mokt'ori	scarf
	12.	pap+sapal	paps'abal	rice-bowl
II.	1.	polum+tal	porimt'al	full moon
	2.	mom+cis	momc'it	gesture
	3.	pam+kil	pamk'il	walk at night
	4.	an+pang	anp'aŋ	main living room
	5.	son+tung	sont'iŋ	back of the hand
	6.	nwun+songi	nuns'oŋi	snow flake
	7.	pang+patak	paŋp'adak	floor
	8.	tung+cwulki	tiŋc'ulgi	line of the backbone
	9.	khong+kwuk	k^{h}oŋk'uk	bean soup
	10.	kal+tay	kalt'æ	reed
	11.	mwul+koki	mulk'ogi	fish
	12.	mal+soli	mals'ori	voice
III.	1.	i+sol	a. its'ol[5]	tooth brush
			b. is'ol	

[4] For the treatment of *p'* through *k'* series and *p^h* through *k^h* as single phonemes rather than sequence of phonemes, see Kim(1967 : 155-57). For phonetic representations I do not strictly follow Martin et al.'s (1967 : xi-xii) Pronunciation Rules, particularly § 7 through § 10.

[5] It is not obvious which forms are correct phonetic represenations. Both *a* and *b* forms are considered as variant forms in this paper.

2. may+tol	a. mætt'ol	millstone
	b. mæt'ol	
3. pay+cim	a. pætc'im	boat cargo
	b. pæc'im	
4. cho+pwul	a. c^hotp'ul	candle light
	b. c^hop'ul	
5. kiwa+cang	a. kiwatc'aŋ	tile
	b. kiwac'aŋ	
6. cha+saks	a. c^hats'ak	fare
	b. c^has'ak	
7. pa+cwul	a. patc'ul	rope
	b. pac'ul	
8. nalwu+pay	a. narutp'æ	ferry boat
	b. narup'æ	

Sample derivation:

	/ttek+ +kwuk/	/pam+ +kil/	/may+ +tol/
T epenthesis:	ttek+t+kwuk	pam+t+kil	may+t+tol
Tensing:	ttek+t+k'wuk	pam+t+k'il	may+t+t'ol
3C cluster[6] simplification:	ttek+ +k'wuk	pam+ +k'il	
Surface Form:	[t'əkk'uk]	[pamk'il]	[mætt'ol]

There are other cases, however, where this rule does not meet the structural description, but tensification happens, setting aside the undergoing of voicing as in *khong+ +pap* [k^hoŋbap] 'bean-mixed rice' and many other examples in IX (p. 6).

The voiceless obstruents become tense without exceptions in the conjugation of some verbs whose roots end in *-m* or *-n*, and also in other complex combinations, as we find in the following examples.

IV. 1. kam-ta	kamt'a	indicative 'coil; wash hair'
-ko	k'o	gerundive
-ca	c'a	propositive
-so	s'o	indicative (plain speech)

[6] For the formalized tensing rule, see Rule (2) on page 5. 3-consonant-cluster simplification or simply consonant reduction has not been satisfactorily formalized. I am going to follow Kim's rule (1967 : 11, 1970b: 5).

$$\left[\begin{matrix}-\text{grave}\\+\text{cons}\end{matrix}\right] \rightarrow \phi \;/\; [+\text{cons}] - \left\{\begin{matrix}\#\\[+\text{cons}]\end{matrix}\right\}$$

$$[+\text{cons}] \rightarrow \phi \;/\; - \left\{\begin{matrix}\#\\[+\text{cons}]\end{matrix}\right\}$$

	2. sin-ta	sint'a	indicative 'put on shoes'
	-ko	k'o	gerundive
	-ca	c'a	propositive
	-so	s'o	indicative (plain speech)
V.	1. ip-ta	ipt'a	put on clothes
	2. mek-ci	məkc'i	(I) shall eat
	3. kop-so	kops'o	be beautiful
	4. pes-ki	pətk'i	taking off
	5. anc-ta	ant'a	sit

Rule (1) may not be permitted to apply in these complex combinations which are linked by a bound morpheme marker instead of a compound boundary element.

The examples given below where stops and fricatives become tensified regularly after the future marker functioning as an attributive adjective *-(u)l*, on the other hand, permit Rule (1) applicable across the word boundary.

VI.	1. cwu-l#ton	cult'on	money to give
	2. ha-l#kes	halk'ət	thing to do
	3. sa-l#cip	salc'ip	house to live in
	4. o-l#salam	ols'aram	man to come
	5. mek-ul#pap	məgɨlp'ap	rice to eat
	6. anc-ul#cali	anjɨlc'ari	seat to sit on

In this case we may account for the application of Rule (1) by distinguishing two kinds of word boundary: 'stable boundary', and 'unstable boundary' which may optionally be deleted (Kim 1970a:18). It is inadequate to account for the cases of IV (*kam-ta* [kamt'a]), V (*ip-ta* [ipt'a]), and many Sino-Korean words. Tensing occurs very frequently in the interior of Sino-Korean words that may be assumed to have a zero boundary. A few examples are cited in VII.

VII.	1. paltal	palt'al	development
	2. kyelceng	kyəlc'əŋ	decision
	3. kyelsek	kyəls'ək	absence
	4. cengka	cəŋk'a	fixed price
	5. coken	cok'ən	condition
		cokk'ən	
	6. ikwa	ik'wa	science department
		ikk'wa	

Other problems still remain. Rule (1) may generate III-*a* forms, but not *b* forms which are considered as variant forms.

	/may+ +tol/	/pay+ +cim/
T epenthesis:	may+t+tol	pay+t+cim
Tensing:	may+t+t'ol	pay+t+c'im
Surface Form:	[mætt'ol]	[pætc'im]

The phonetic forms in I (*mok+toli* [mokt'ori]) and also in V (*ip-ta* [ipt'a]) can be accounted for, without the application of *t* epenthesis rule and 3-consonant-cluster simplification rule, directly by means of the tensing rule in disregard of boundary.

(2). Tensing Rule

$$\begin{bmatrix} -\text{son} \\ -\text{voice} \\ -\text{asp} \end{bmatrix} \rightarrow [+\text{tense}] \; / \; \begin{bmatrix} -\text{son} \\ -\text{voice} \end{bmatrix} \; -$$

	/path+kolang/	/ip-ta/
Neutralization:	pat+kolang	
Tensing:	pat+k'olang	ip-t'a
Surface Form:	[patk'oraŋ]	[ipt'a]

The epenthesis rule seems to be closely related, as Kim tries to incorporate it, and the following examples (VIII, 1-5) partly support it, with the behavior of boundary our understanding of which is still limited. The role of boundary is, however, not the necessary and sufficient condition for tensification, as Kim (1970a:20) leaves unexplained the question of what exactly the environment of epenthesis is. The examples 6 through 11 demonstrate this fact.

VIII. 1. a.	kamca	kamja	potato
b.	kam-ca	kamc'a	let us coil
2. a.	camcali	camjari	fragonfly
b.	cam+cali	camc'ari	sleeping place
3. a.	hoswu	hosu	lake
b.	ho+swu	hots'u	number of houses
4. a.	muncang	munjaŋ	piece of writing
b.	mun+cang	munc'aŋ	curtain
5. a.	nay-ka	næga	I (and subject marker)
b.	nay+ka	næk'a	stream side
		nækk'a	
6. a.	munca	munja	idiomatic phrase
b.	munca	munc'a	letters
7. a.	muncen	munjən	grammar
b.	mun+cen	munjən	front of a gate
8. a.	cencek	cənjək	books; transfer of register
b.	cencek	cənc'ək	overall
9. a.	nwun+palam	nunbaram	snow and wind

	b. nwun+palam	nunp'aram	snow-chilled wind
10.	a. khong+pap	kʰoŋbap	bean-mixed rice
	b. kong+pap	koŋp'ap	free meal
11.	a. swul+canchi	suljancʰi	drinking party
	b. swul+can	sulc'an	wine cup

In Korean phonology the epenthesis may be said to be motivated primarily as a tactical device to tensify the following voiceless obstruents, in other words, to provide an input for the tensing rule. The epenthesis rule may morphologically be interpreted as a combining factor as many Korean grammarians assert. Whatever it is, it is certain that Rule (1) needs modification in order to be able to give a convincing and comprehensive account for *toyn soli* phenomenon, although we put aside the cases in which voicing applies or tensing is blocked as illustated below.

IX. 1.	wum+toti	umdoji	sprout
2.	mom+cosim	momjosim	taking care of oneself
3.	pom+kali	pomgari	spring plowing
4.	pan+tal	pandal	half moon
5.	khong+pap	kʰoŋbap	bean-mixed rice
6.	salang+pang	saraŋbaŋ	detached party room
7.	cang+colim	caŋjorim	meat boiled down in soy
8.	kkwul+pel	k'ulbəl	honey bee
9.	kol+pang	kolbaŋ	back room
10.	thel+sil	tʰəlsil	wollen yarn
11.	kiwa+cip	kiwajip	tile-roofed house
12.	cho+pap	cʰobap	seaweed rice

3. Tensing or Voicing: Unpredictability

There is a voicing rule independently motivated in Korean which applies to /p, t, c, k/ in the words like the examples in IX above.

(3). Voicing Rule

$$\begin{bmatrix} \text{-cont} \\ \text{-asp} \\ \text{-tense} \end{bmatrix} \rightarrow [+\text{voice}] \;/\; [+\text{voice}] - [+\text{voice}]$$

As we can see, there is an overlapping condition for both tensing and voicing of the voiceless consonants, i.e., the string of segments···[+son] (\$) $\overline{[-\text{voice}]}$ [+voice]···· The unpredictable alternation appears in this environment as shown in II, III, VII and IX. It is not possible to find any constraints that may be placed on the voicing and/or tensing rule so as to be able to generate voiced or tensified phonetic representations in a phono-

logically regular and predictable way, except the cases of IV (*kam-ta* [kamt'a]) and VI (*cwu-l#ton* [cult'on]) where tensification is regularly predictable and determinable at least morphologically.

I find it difficult to grasp any decisive clue to the environment for the alternation.[7] Tensification is hardly amenable to the peripheral/central or homorganic/nonhomorganic sound distinction, even though consonant cluster simplification is clearly amenable to the 'principle of close articulation' (Kim 1971 : 90, 1973: 1-2), as demonstrated in the following examples.

nwun+pich	nunp'it	eye color	C P	tensified
nwun-+kwumeng	nunk'umə̆ŋ	eye socket	C P	tensified
nwun+tongca	nunt'oŋja	apple of eye	C C	tensified
nwun+siwul	nuns'iul	edge of eyelid	C C	tensified

Neither the quality nor the length of surrounding vowels could be a determinant factor, as illustrated below.

1.	salang+pang	saraŋbaŋ	party room	—a..a—	voiced
	an+pang	anp'aŋ	living room		tensified
2.	nwun+cil	nunjil	staring	—u..i—	voiced
	wum+cip	umc'ip	underground shack		tensified
3.	khong+pap	kʰoŋbap	bean-mixed rice	—o..a—	voiced
	pom+palam	pomp'aram	spring wind		tensified
4.	nwun+kil	nunk'il	line of vision		tensified
	nwūn+kil	nūnk'il	snowy road		tensified
5.	sāken	sāk'ən	affair		tensified
	swūken	sūgən	towel		voiced

[7] I am tempted to speculate that tensification seldom occurs in original Korean words without at least a morpheme boundary. Incidentally, Lee's (1972 : 466-67) observation that "when both of the compounded words are polysyllabic (frequently of Chinese origin) *t* insertion does not take place", is partly correct. Following examples of mine will support Lee's claim.

1.	palen+kwen	parənk'wən	the right to speak
	palen+kwenli	parəngwəlli	the right to speak
2.	ceyil+sim	ceils'im	the first trial
	ceyil+simli	ceilsimni	the first trial
3.	kipon+pep	kibonp'əp	the basic law
	kipon+peplyul	kibonbəmyul	the basic law

But Lee's constraint on tensing in polysyllabic compounded words is too strong. Consider a few counterexamples:

seyswu+pinwu	sesup'inu	toilet soap
sewul+salam	səuls'aram	Seoulite
sengyang+kaypi	səŋnyaŋk'æbi	matchstick
tomay+kakyek	tomæk'agyək	wholesale price

6.	pom+kamwul	pomk'amul	spring drought	tensified
	pom+kali	pomgari	spring plowing	voiced
7.	sako	sago	thought	voiced
	sāko	sāgo	accident	voiced
8.	sika	sik'a	current price	tensified
	sīka	sīk'a	market price	tensified

Before presenting an alternative rule for tensification, how should we treat this alternation as being unpredictable and exceptional to either voicing or tensing? We should provide some device for characterizing this exceptionality or irregularity. Even worse, this task is not simple within the recent theory of generative phonology, although we can explain the cases of IV and VI as a matter of morphologically motivated phonological processes. When we treat the other cases (II, III, VII, and IX) as being irregular, we can not simply enter morphemes in the lexicon as [α voicing rule] or [α epenthesis rule], nor as [α context voicing] or [α context epenthesis].[8]

Let us consider, for example, the morpheme *pang* 'room'. It may be entered in the lexicon as [+voicing rule]. Now given a form such as *kol+pang* 'back room', the voicing rule can apply to the *p* in *pang* and produce [kolbaŋ]. But what about the form *an+pang* where *p* is not voiced but tensified? *Pom* 'spring' may be specified as [+context voicing rule]. Thus, in *pom+kali* 'spring plowing', *k* may become voiced. But how could we block the tensification of *p* in *pom+palam* 'spring wind'?

4. ʔ Epenthesis and Metathesis Approach

Phonetically the tensification of voiceless obstruents seems to be ascribed to the influence of implosion, or more accurately speaking, unrelease[9], or to the influence of glottalic constriction in a syllable boundary. Cho (1967 : 157) explains the phonetic aspect of what he calls 'laryngealization' as follows:

> One of the phonetic meanings of the substantival compound formation occurs when either the glottal stop or implosives are felt on the combinational boundary or at the final of the first morpheme of the complex combination, and the stem final is pronounced as if it were an implosive or glottal stop.

Cho (1967 : 254-59) argues at great length for the status of ʔ as a phoneme in Korean, presenting synchronic and diachronic evidence. He assigns the assumed underlying /ʔ/ to

[8] For the discussion of the treatment of exceptions, see Chomsky and Halle (1968 : 172-76, 373-76), and Kisseberth (1970).

[9] According to Kim (1970b: 5, 1971: 87), Korean stops are unreleased word finally and before a consonant.

all the compound combination, and to the complex combination when the first morpheme ends in a vowel, that is, where *sai sios* is marked in modern Hankul spelling. In his descriptive treatment of 'laryngealization', however, any direct correlation between underlying ʔ and derived forms is not expounded at all.

Choy (1959 : 696) has also stated, quite rightly,the following:

> If we consider the principle of sound and want to use one sound universally for the epenthetic sound, ㆆ (ʔ) is preferable to ㅅ(*s*). We use *s*, however, for conventional convenience. [Translation is mine.]

On this ground and for other reasons that follow, *toyn soli* phenomenon should be explained to result from two different sources: cases where the implosion of preceding obstruents causes tensing regularly like the examples in I and V; and cases where glottalization results from the epenthesis of a glottal stop after a [+sonorant] segment in a syllable boundary. It must be noted that both 'tensity' and 'glottalic constriction' are realized only as /p', t', c', k', s'/ in Korean.[10] Thus the epenthetic sound is assumed to be a glottal stop.

(4) ʔ Epenthesis Rule[11]

$$\phi \rightarrow [+\text{glot const}] \;/\; [+\text{son}] \;\$ - \begin{Bmatrix} -\text{son} \\ -\text{voice} \\ -\text{asp} \end{Bmatrix}$$

With this rule *pam+kil* (II-3) and *an+pang* (II-4) become *pamʔkil* and *anʔpang*. Rule (2) (Tensing) may as a next step be applied to give *pamʔk'il* and *anʔp'ang*. Finally 3-consonant-cluster simplification will produce the surface forms [pamk'il] and [anp'aŋ] respectively. However, this process of derivation is not adequate for the forms in III-*b*. Let us see two sample derivations in the same order.

	/i+sol/	/may+tol/
ʔ epenthesis:	iʔsol	mayʔtol
Tensing:	iʔs'ol	mayʔt'ol

3-consonant-cluster simplification is blocked to apply. Now the consonant neutralization

[10] Kim has pointed out /p', t', k'/ are voiceless unaspirated tense series of stop which have glottal constriction, but not glottal closure. Cited from Chomsky and Halle (1968: 315, 326).

[11] As we have already known, this rule does not apply in some cases, although the structural description is met. There is a considerable variation in the occurrence of tensification in different dialect areas (Martin 1954: 55) and in different generations (Cho 1967: 156). *Toyn soli* is found more often in the pronunciation of the younger generation, and more frequent in Seoul and the North than in the South. As far as I am concerned, there is an alternation in pronunciation in some words and compounds. For example, *changko* 'storehouse' and *sewul+patak* 'Seoul area' are pronunced in either [cʰaŋgo] and [səulbadak] or [cʰaŋk'o] and [səulp'adak] respectively.

rule already existent in Korean will take care of this.

(5). Consonant Neutralization Rule[12]

$$p^h \rightarrow p$$

$$\left\{\begin{matrix} t^h \\ c \\ c^h \\ s \\ s' \\ h \\ ? \end{matrix}\right\} \rightarrow t \;/\; - \left\{\begin{matrix} \# \\ C \end{matrix}\right\} \;/$$

$$\left\{\begin{matrix} k^h \\ k' \end{matrix}\right\} \rightarrow k$$

iph	'leaf'	[ip]
nath	'piece'	
nac	'daytime'	
nach	'face'	
nas	'sickle'	[nat]
nass-	'came out'	
nah-	'bear'	
na?-(?)	'get well'	
pwuekh	'kitchen'	[puək]
pakk	'outside'	[pak]

After the application of Rule (5) we have [its'ol] and [mætt'ol]. But what about the variant forms of III-*b*, such as [is'ol], [mæt'ol], and *coken* [cok'ən]?

One way to generate the variant forms is to posit the metathesis rule.

(6). ? Metathesis Rule

	[+son]	[+glot const]	$\left[\begin{matrix} -\text{son} \\ -\text{asp} \end{matrix}\right]$
SD:	1	2	3
SC:	1	$\left[\begin{matrix} 3 \\ +\text{glot const} \end{matrix}\right]$	

Condition: If 1 is [+syll], this rule is optional.

There is sufficient justification for the motivation of ? metathesis as well as epenthesis. Even though the phonological features and values of *h* and ? have been controversial, *h* and ? may be said to be of similar property and behavior in many respects. In *The Sound Pattern of English* (Chomsky and Halle 1968: 303) *h* and ? are considered as one of seven categories of speech sounds, i.e., Glide (II). They are also classified as Laryngeal Glides and characterized as $\left[\begin{matrix} -\text{syll} \\ -\text{son} \\ -\text{cons} \end{matrix}\right]$ in *Generative Phonology* (Schane 1973: 20, 27). On the basis of the similar property and parallelism between these two sounds, Rule (6) can be motivated.

As the examples given below illustrate, *h* metathesizes if followed by a verbal or

[12] It is not easy to express these phonological processes in feature notation that captures neatly the generalizations. I am tempted, nevertheless, to write a tentative rule as follows:

$$\left[\begin{matrix} -\text{son} \\ \alpha\ \text{cor} \end{matrix}\right] \rightarrow \left[\begin{matrix} +\text{cons} \\ -\text{cont} \\ -\text{asp} \\ -\text{tense} \\ -\text{del rel} \\ \alpha\ \text{cor} \end{matrix}\right] /\; - \left\{\begin{matrix} \# \\ [+\text{cons}] \end{matrix}\right\}$$

For the 'conspiracy' between this consonant neutralization and the consonant reduction, and for the principle or the formalized rule that governs the latter, see Kim (1970b , 1971). It seems dubious that consonant neutralization and reduction should be considered as a single process, however complicated the formal notation may be.

adjectival ending that begins with /t, c, k, s(ʔ)/.

1.	manh-ta	mant^{h}a	be many/much
2.	silh-ciman	silc^{h}iman	be disagreeable
3.	talh-ta	talt^{h}a	be worn
4.	coh-ko	cok^{h}o	be good
5.	ccih-ca	c'ic^{h}a	pound
		c'itc'a	
6.	ccih-ki	c'ik^{h}i	pounding
		c'itk'i	
7.	phalah-so	p^{h}aras'o	be green
		p^{h}arats'o	
8.	silh-so	sils'o	dislike

If the alternative pronunciations shown in 5 through 7 are free variations, some items in which *h* is preceded by a vowel may be said to undergo an optional, obligatory, not metathesis. Furthemore if *h* does not undergo metathesis, it may meet the structural description of the later rule(s), such as the consonant neutralization. A parallelism in optionality and in undergoing the next rule is found between *h* metathesis and ʔ metathesis.

Consider:

	/may+tol/		/ccih-ca/		/phalah-so/	
ʔ epen:	may'tol					
ʔ/*h* meta:	mayt'ol	---	ccic^{h}a	---	phalas'o[13]	---
C neut:	---	maytt'ol	---	ccitca	---	phalatso
Tensing:	---	maytt'ol	---	ccitc'a	---	phalats'o
Surface:	[mæt'ol]	[mætt'ol]	[c'ic^{h}a]	[c'itc'a]	[p^{h}aras'o]	[p^{h}arats'o]

In order to be able to produce two variant phonetic representations in III, and to gain simplicity in the derivation of the surface forms in II and other groups, ʔ epenthesis and metathesis are preferred to *t* insertion and deletion. By positing Rules (4) and (6), we can avoid an unnecessary step. Compare the following three derivational processes.

/celm-ta/ 'be young'

1). *T* epen:	celmtta	2). 3C cl s:	cemta	3). ʔ epen:	celmʔta
Tensing:	celmtt'a	*T* epen:	cemtta	ʔ meta:	celmt'a
4C cl s:	celmt'a	Tensing:	cemtt'a	3c cl s:	cemt'a

[13] I am not quite sure whether s^{h} is realized as *s'*, since there is no/ s^{h}/ in Korean. This phenomenon could be another convincing evidence for the similar property of *h* and ʔ in Korean. For the explanation of 'laryngealization' of *s* as the strengthening of *s* under the influence of common phonetic quality of friction between *s* and *h*, see Cho (1967:157).

3C cl s:	cemt'a	3C cl s:	cemt'a	---
Surface:	[cəmt'a]		[cəmt'a]	[cəmt'a]

To sum up the given analysis, sample derivations of various circumstances are presented below:

Group	I	V	II, IV, VI, VII	III	
	/aph+kil/	/anc-ta/	/an+pang/	/pay+cim/	
Epen:	---	---	an?pang	pay?cim	
Meta:	---	---	anp'ang	payc'im	---
Neut:	apkil	---	---	---	paytcim
Tens:	apk'il	anct'a	---	---	paytc'im
Redu:	---	ant'a	---	---	---
Surf:	[apk'il]	[ant'a]	[anp'aŋ]	[pæc'im]	[pætc'im]

At this point in the discussion, we have noticed that these rules are crucially ordered, as the derivational processes have demonstrated.

1. ? Epenthesis
2. ? Metathesis
3. Consonant Neutralization
4. Tensing
5. Consonant Reduction

5. Conclusion

Thus far I have discussed the *toyn soli* phenomenon to support the idea that it results from two different sources: implosion (unrelease) and glottalic constriction; and that the epenthetic sound is a glottal stop. I have posited ? epenthesis and metathesis on the basis of the parallelism between the behavior of *h* and that of ?. This assumption clearly gains naturalness and simplicity.

Furthermore this approach to accounting for tensification has some other significant implications in relation to other phenomena in Korean phonology. First, the insertion of a glottal stop or a glide is very frequent in many languages. Moreover, as Kim (1973: 6) has accurately pointed out, if "the additive consonant in Korean is restricted to peripheral sounds", the glottal stop insertion does fit the principle of close articulation and 'gravity' in Korean phonology.

Secondly, if either we assume ? in underlying representations of the so-called '*s* irregular verbs' in modern Korean, or we apply the ? epenthesis rule to those irregular verbs, we can provide a neat solution to the irregularity. As far as *s* irregular verbs are concerned, the so-called irregularity can not be "irregular," if a different underlying representa-

tion is assumed and tensification is allowed to apply to those verbs. A sample derivation is given below, instead of a long discussion.

Underlying ʔ Solution			ʔ Epenthesis Solution		
	/iʔ-ta/ 'connect'			/i-ta/ 'connect'	
			ʔ epen:		i ʔ ta
ʔ meta:	it'a	--	ʔ meta:	it'a	--
C neut:	--	itta	C neut:	--	itta
Tensing:	--	itt'a	Tensing:	--	itt'a
Surface:	[it'a]	[itt'a]		[it'a]	[itt'a]

For the ending that begins with a vowel, we may apply the glottal stop deletion on the analogy of the optional *h* deletion rule in the same environment: [+son]—[+syll]. For example,

simhi	'severely'	simhi
		simi
koyohi	'quietly'	koyohi
		koyoi

The following optional ʔ deletion rule will produce two variant pronunciations: [iʔə] and [iə]. ʔ →ϕ/ [+son]—[+syll]

Thirdly, the assumption of glottal stop as an epenthetic sound is historically relevant. It is well known that in the documents of the earlier part of the Middle Korean period the epenthetic sound was designated by more than six different graphic signs: ㅸ(p), ㅱ(w), ㆆ(ʔ), ㄱ(k), ㄷ(t), and ㅅ(s).

Finally, if the glottal stop is really non-existent phoneme in Modern Korean since it occurs nowhere else by itself,—although there are some convincing cases where /ʔ/ is recognized as in *s* irregular verbs such as *kuʔ-* 'draw', *ciʔ-* 'build' and so forth, — we may consider ʔ as an extrasystematic phoneme, "which is not part of the regular contrastive system of phonemes" (Pike 1966: 143), or on the subphonemic phonetic level. Then the unpredictable alternation between voicing and tensing in the same immediate phonemic environment may be attributed to the very nature of the extrasystematic phoneme ʔ that is restricted to specific styles of speech in different dialect areas and in different generations.

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